

What is claimed is:

1. A method of ejecting ink comprising:
 - (a) filling a rear end of a nozzle with ink using a capillary force, the rear end of the nozzle being surrounded by a hydrophilic layer;
 - (b) forming an electric field directed toward an outlet of the nozzle on a front end of the nozzle, the front end of the nozzle being surrounded by a hydrophobic layer;
 - (c) varying a surface tension of ink to separate ink droplets having a predetermined volume from ink and to move the separated ink droplets within the front end of the nozzle toward the outlet of the nozzle; and
 - (d) ejecting the separated ink droplets through the outlet of the nozzle.
2. The method as claimed in claim 1, wherein forming an electric field directed toward the outlet of the nozzle comprises:

sequentially applying a voltage to a plurality of electrode pads, the plurality of electrode pads being disposed on the front end of the nozzle at predetermined intervals in a lengthwise direction of the nozzle.
3. The method as claimed in claim 2, wherein varying the surface tension of ink comprises:

lowering the surface tension of ink adjacent to one of the plurality of electrode pads to which the voltage is applied so that a contact angle of ink with respect to the hydrophobic layer is reduced.

4. The method as claimed in claim 2, wherein forming the electric field and varying the surface tension of ink comprises:

sequentially applying a voltage to a first electrode pad and a second electrode pad of the plurality of electrode pads to move ink within the front end of the nozzle to a position corresponding to a location of the second electrode pad; and

cutting off the voltage applied to the first electrode pad to separate the ink droplets from ink.

5. The method as claimed in claim 4, wherein after the separation of the ink droplets from ink, (c) further comprises:

cutting off the voltage applied to the second electrode pad and sequentially applying a voltage to at least one electrode pad of the plurality of electrode pads disposed after the second electrode pad to move the separated ink droplets toward the outlet of the nozzle.

6. The method as claimed in claim 2, wherein an area of each of the plurality of electrode pads is variable so that a volume of the ink droplets is adjustable.

7. The method as claimed in claim 2, wherein a moving speed of the separated ink droplets in the front end of the nozzle is adjusted by a time

difference during the sequential application of the voltage to the plurality of electrode pads.

8. The method as claimed in claim 2, wherein (d) further comprises:

cutting off the voltage applied to an electrode pad where the ink droplets are located, prior to ejecting the separated ink droplets.

9. The method as claimed in claim 1, wherein in (d), the ejection of the separated ink droplets is performed by an electrostatic force.

10. The method as claimed in claim 1, wherein in (d), the ejection of the separated ink droplets is performed by lowering an atmospheric pressure around the outlet of the nozzle.

11. An ink-jet printhead, comprising:
a capillary nozzle, including a rear end being surrounded by a hydrophilic layer, a front end being surrounded by a hydrophobic layer, and an outlet;

an insulating layer, which is formed at an external surface of the hydrophobic layer along a lengthwise direction of the nozzle;

a plurality of electrode pads disposed at an external surface of the insulating layer at predetermined intervals along the lengthwise direction of the nozzle;

an opposite electrode disposed at an external surface of the hydrophobic layer and opposite to the plurality of electrode pads;

a voltage applying unit, which sequentially applies a voltage to the plurality of electrode pads and forms an electric field directed toward the outlet of the nozzle to separate ink droplets having a predetermined volume from ink and move the separated ink droplets toward the outlet of the nozzle; and

a droplets ejecting unit, which ejects the separated ink droplets through the outlet of the nozzle.

12. The ink-jet printhead as claimed in claim 11, wherein the hydrophobic layer is a porous layer, and the opposite electrode and the separated ink droplets are electrically connected via porosities of the porous layer.

13. The ink-jet printhead as claimed in claim 11, further comprising:

a plurality of through holes formed in the hydrophobic layer at a location corresponding to the opposite electrode, wherein the opposite electrode and the separated ink droplets are electrically connected via the plurality of through holes.

14. The ink-jet printhead as claimed in claim 11, further comprising:

a plurality of probes provided on the opposite electrode, the plurality of probes perforating the hydrophobic layer, wherein the opposite electrode and the separated ink droplets are electrically connected via the plurality of probes.

15. The ink-jet printhead as claimed in claim 11, wherein the nozzle has a rectangular cross-sectional shape.

16. The ink-jet printhead as claimed in claim 11, wherein the nozzle has a circular cross-sectional shape.

17. The ink-jet printhead as claimed in claim 11, wherein the plurality of electrode pads is three electrode pads disposed in a line.

18. The ink-jet printhead as claimed in claim 11, wherein the voltage applying unit comprises:

a first power source connected to each of the plurality of electrode pads; and

a control unit, which is provided between the first power source and the plurality of electrode pads, the control unit controlling the first power source so that a voltage is sequentially applied from the first power source to the plurality of electrode pads.

19. The ink-jet printhead as claimed in claim 11, wherein the voltage applying unit comprises:

a plurality of power sources, each of the plurality of power sources being connected to a corresponding one of the plurality of electrode pads.

20. The ink-jet printhead as claimed in claim 11, wherein the droplets ejecting unit comprises:

an external electrode installed to face the outlet of the nozzle; and
a second power source for applying a voltage to the external electrode to form an electric field between the nozzle and the external electrode, wherein the separated ink droplets are ejected through the outlet of the nozzle due to an electrostatic force acting on the separated ink droplets.